# SECTION 26 33 01

# DC BATTERY SYSTEM

## PART 1 - GENERAL

### 1.01 SECTION INCLUDES

A. Batteries.

B. Battery rectifier/chargers.

C. Fused disconnect switches and circuit.

D. DC distribution panels.

### 1.02 MEASUREMENT AND PAYMENT

A. General: DC battery system, as specified herein, will not be measured separately for payment but will be paid for as part of the Contract lump-sum price for the related electrical or electronic systems work as indicated in the Bid Schedule of the Bid Form.

### 1.03 REFERENCES

A. American Society for Testing and Materials (ASTM)

1. ASTM B187 Standard Specifications for Copper Stock

B. National Electrical Manufacturers Association (NEMA)

1. NEMA 250 Enclosures for Electrical Equipment (600 Volts)

2. NEMA AB 1 Molded Case Circuit Breakers

3. NEMA PB 1 Panelboards

4. NEMA PB 1.1 Instruction for Installation and Maintenance of Panelboards

C. Underwriters Laboratories, Inc. (UL)

1. UL 67-88 Standards for Safety Panelboards

### 1.04 SUBMITTALS

A. Power consumption calculations. Estimated average power and peak power demand shall be provided.

B. Battery and battery charger sizing calculations. Maximum battery load for the purposes of sizing is 25 Amperes.

C. Product data and catalog cuts for battery, battery chargers, dc distribution panels, circuit breakers, and fused disconnect switches.

## PART 2 - PRODUCTS

### 2.01 SYSTEM REQUIREMENTS

A. General

1. DC battery systems shall include a primary input circuit breaker, isolation transformer, batteries, battery charger, dc filter, battery racks, fused disconnect switch, dc distribution panel, and related accessories as specified herein.

2. Battery systems shall be provided in the stations, train control houses, and ventilation structures, as shown in the Contract Drawings. The battery systems shall supply power to equipment as shown in the Contract Drawings.

3. Battery systems shall be sized to provide 50 percent additional capacity over the calculated equipment power load.

B. Batteries

1. The Batteries shall be of heavy-duty, sealed, and maintenance-free design with solid copper, lead-plated posts in individual cells. The battery cells shall;

   a. Be sealed valve-regulated lead-acid type;
   b. Consist of individual cells in molded, flame-retardant, durable and impact resistant cases;
   c. The Posts shall be bolted with lead plated copper bars using stainless steel hex-head nuts;
   d. Be warranted free from defects in materials and workmanship for five years;
   e. Be warranted to retain at least 80 percent of rated capacity for 20 years from the date of acceptance;
   f. Not vent any gas under normal operation; and
   g. Be provided with sealed pressure relief and flame arrester.

2. Ratings

   a. The battery voltage rating shall be as indicated with a tolerance of plus 16 percent or minus 12 percent. Battery shall have ampere-hour capacity to provide rated power to all connected equipment and devices for eight hours.

   b. The battery shall be able to retain full capacity during long term float service without maintenance.

   c. The battery shall be sized to provide full operation for eight hours at 50°C ambient without charger.

   d. The battery shall be able to start up after AC supply failure. The line breaker must be closed before voltage to the charger is restored.

3. Cell Containers

   a. The individual cell housing shall be heat-resistant and shall not deteriorate or become cloudy upon exposure to the electrolyte.

   b. The covers shall be cemented in place to provide a permanent leak-proof seal.

   c. Cell terminal posts shall be clearly and permanently identified. Electrolyte level lines shall be marked on all four sides of the cell housing.

4. Nameplates. Each battery shall be legibly and permanently marked with the following:

   a. Manufacturer's name;
   b. Battery and cell type;
   c. One-minute, one-hour, and eight-hour ampere ratings;
   d. Month and year of manufacture; and
   e. Ampere-hour capacity for eight hours.

5. Accessories. A set of accessories shall be provided for each set of batteries, which shall include the following:

   a. One cell-lifting sling, complete with strap and spreader;
   b. One battery log-book;
   c. One quart of terminal grease;
   d. One set of special tools, if required; and
   e. One vent mounted thermometer.

C. Battery Rectifier-Chargers

1. Battery rectifier-chargers shall be of the fully-regulated, silicon-controlled rectifier, convection-cooled, constant-voltage type. The charger shall be rated for operation in the voltage level and number of phases as indicated in the Contract Drawings.

2. The output of the chargers shall be constant-voltage-regulated within one percent over its complete load range and shall be electronically current-limiting, adjustable between 90 and 115 percent.

3. The chargers shall recharge a fully discharged battery within eight hours.

4. The chargers, in addition to charging the battery, shall carry the continuous load, while the battery supplies all of the heavy, non-continuous current demands.

5. The chargers shall be able to operate as a dc power supply without batteries.

6. The battery chargers shall be equipped with the following features:

   a. AC power On pilot light;

   b. Float-equalize switch;

   c. Float and equalizing voltage adjusting potentiometer;

d. Output DC failure alarm relay;

e. Surge and transient protection;

f. Ground detector relay;

g. DC high-low voltage alarm relay;

h. DC output thermal-magnetic circuit breaker;

i. DC ammeter; and

j. DC voltmeter.

D. Fused Disconnect Switches and Circuit

1. A two-pole hand-operated fused disconnect switch shall be provided between the battery and the battery charger.

a. The fuse rating and switch size shall be coordinated with the dc output circuit breaker of the battery charger.

b. The disconnect switch and fuse shall be mounted in a NEMA Type 1 enclosure.

2. Circuit breakers shall be NEMA AB 1 molded case, quick-break, bolt-on type, with thermal-magnetic type overload trip, suitable for ac or dc operations.

E. DC Distribution Panels

1. General

a. The dc distribution panelboards shall comply with the requirements of UL 67, NEMA 250, NEMA AB 1 and NEMA PB 1.

b. Each distribution panelboard shall contain a main power circuit breaker and branch circuit breakers with spacer blanks and bus provisions for future branch circuit breaker installations, as shown on Contract Drawings.

c. The panel board shall be in NEMA Type 1 door-in-door enclosure made of galvanized steel, for surface mounting with multiple knockouts and wiring gutters.

d. Each distribution panelboard shall be provided with a swinging door with full-length piano hinge and a flush spring latch.

e. The open door shall expose the dead-front circuit breaker handles and a circuit breaker card directory.

f. Interior components shall be mounted on backplate of reinforced steel for rigid support and accurate alignment.

2. Electrical Requirements

a. The panelboards shall be rated for short circuit currents of 10,000 amperes and be equipped with two-pole molded case circuit breakers and a positive and negative bus bars.

b. Bus bars shall be ASTM B187, 98 percent conductivity copper, with silver-plated contact surface.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

A. The installation of the dc distribution panelboards shall comply with the requirements of NEMA PB 1.1.

B. Train Control Rooms

1. The battery shall be mounted on a two-step, single row type racks. Maximum height of racks shall be 24-inches from floor.

2. The racks shall be bolted to the floor and wall, and shall satisfy the mounting requirements specified in the BART Seismic Design Criteria.

3. The racks shall be constructed of steel channels finished with at least two coats of acid and alkaline resistant gray paint.

4. The battery and rack assembly shall be arranged to provide easy access to each battery cell for maintenance and replacement.

C. Train Control Houses and Ventilation Structures

1. Batteries, rectifier-chargers, and dc distribution panels shall be mounted in a standard EIA 19-inch cabinet.

2. Cabinet mounting shall meet the requirements of the BART Seismic Design Criteria.

### 3.02 TESTING

A. General. Refer to Section 01 45 24 - Testing Program Requirements, covering requirements for test plans, procedures, and results.

B. Factory Tests. The Contractor shall include the tests and certifications listed below, as a minimum requirement, in the overall testing schedule for DC power systems.

1. Temperature rise test.

2. Power loading at 100 percent capacity for 24 hours at 90 degrees F and 90 percent humidity.

C. Field Tests. Power distribution test shall verify that energy at all required level is available and is properly distributed to equipment requiring power both in the field and in the equipment rooms. The test shall include verifying that:

1. No grounds, short circuits, open circuits, crosses, or misplaced wiring exist in the power distribution system;
2. Standby, reserve, and battery power circuitry are complete and operate properly;
3. Output of AC power supplies provide the correct voltage levels and phasing where required; record voltages;
4. Output of dc power supplies provide the correct voltage levels and correct polarity; record voltage and loads;
5. Adjustable transformers or voltage regulators are adjusted correctly; and
6. Ground-fault detectors are operating correctly.

**END OF SECTION 26 33 01**